THE ESTABLISHMENT OF A TRI-SERVICE AMMUNITION DEMILITARISATION FACILITY BY THE UK MINISTRY OF DEFENCE

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Presented at the
DEPARTMENT OF DEFENSE EXPLOSIVES SAFETY SEMINAR
18 - 20 August 1992
Hilton Hotel, Anaheim, California.

ABSTRACT

The advent of more stringent environmental legislation and the loss of Crown Immunity from such legislation has forced the Ministry of Defence to adopt a 'Green' approach to the demilitarisation of ammunition surpluses.

As part of its strategy for the future, the Ministry of Defence (MOD) intends to establish a Tri Service Ammunition Demilitarisation Facility based on rotary kiln incineration technology. This presentation provides an insight into the proposed design of the facility.

INTRODUCTION

In the past, techniques for the demilitarisation of ammunition in UK were designed to meet three criteria: to be safe, efficient and as economic as possible. It is only in recent years that ecological considerations have impacted on established procedures sufficiently to force a new approach. UK is now in that transition period towards the introduction of demilitarisation techniques that are ENVIRONMENTALLY safe, efficient and cost effective. Today I will provide a brief overview of the reasons for change in UK and then describe our proposals for the development of a Tri-Service Ammunition Demilitarisation Facility (TADF).

This subject deals with the logistic disposal of ammunition, that is ammunition stocks which are be disposed of as part of the inventory management process. It does not relate to operational demolition techniques which of necessity give environmental considerations a low priority.

The term 'demilitarisation' is used in this paper to refer to disposal processes which destroy functional characteristics and prevent further use as an item of ammunition, rather than alternative disposal methods such as sale to a third party for operational or training use.

IMPETUS FOR CHANGE

For many years the UK has relied on a combination of sea dumping and open range demolition to dispose of ammunition and explosives. However, in the face of growing national and international awareness of ecological issues and in particular the environmental impact of industrial waste disposal processes we have re-assessed our attitudes to demilitarisation. The specific events which have affected UK are:

1. The progressive loss of traditional disposal resources.

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
AUG 1992		**00-00-1992 to 00-00-1992**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
The Establishment of a Tri-Service Ammunition Demilitarisation Facility by the UK Ministry of Defence	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **UK Ministry of Defence,Directorate of Land Service Ammunition,Vauxhall Barracks,Didcot, UK,**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES
See also ADA260984, Volume I. Minutes of the Twenty-Fifth Explosives Safety Seminar Held in Anaheim, CA on 18-20 August 1992.

14. ABSTRACT
see report

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**	**Same as Report (SAR)**	**7**	

2. Strengthening of environmental legislation and in particular the removal of Crown Exemption for the military.

LOSS OF TRADITIONAL DEMILITARISATION RESOURCES

Dumping at Sea. UK has traditionally relied upon sea dumping to dispose of the majority of it's surplus ammunition. Since 1972 strict controls have been imposed over the natures of ammunition dumped and the dump site itself. All ammunition and explosives have been dumped in a single deep sea site in the Atlantic at a depth of 4525 metres. UK is already committed to protocols under the OSLO Convention which prohibit the dumping of industrial waste (including ammunition and explosives) in the North Sea. From 1 January 1993 the OSLO Convention will be officially extended to encompass the European half of the Atlantic which includes MOD's dumping site. This imposes a clear deadline for the termination of deep sea dumping and requires that alternative methods of disposal are established.

Open Range Demolitions. There are very few truly isolated places in the UK and explosive limits on demolition ranges have been progressively reduced over recent years in response to complaints from the public over noise and ground shock. In many areas it is no longer economical to employ demolition techniques for logistic disposal tasks and there is a growing recognition that ranges are better employed in support of operational and training requirements. It is also recognised that environmental considerations will increasingly restrict the range of munitions which can be disposed, making it even more necessary that MOD develop other means of demilitarisation.

ENVIRONMENTAL LEGISLATION

The Environmental Protection Act (EPA), passed in November 1990, is a stronger and more enforceable piece of legislation than was previously in force.

Under the EPA, waste processes are required to meet Best Available Technique Not Entailing Excessive Cost (BATNEEC) and Best Practicable Environmental Option (BPEO) principles. Although guidance notes have not yet been issued, it is expected that the following air emission limits (based on EEC proposals) will apply to the burning of waste up to 1 tonne/hour:

Particulate matter	20 mg/m3
Sulphur Dioxide	50 mg/m3
Hydrogen Chloride	30 mg/m3
Hydrogen Fluoride	2 mg/m3
Carbon Monoxide	50 mg/m3
Oxides of nitrogen as NO2	650 mg/m3
Total free halogen's	5 mg/m3

Heavy Metals and their compounds (expressed as metals):

Cadmium & Thallium together	0.05 mg/m3
Mercury	0.05 mg/m3
Antimony,arsenic,lead,chromium, cobalt,copper,manganese,tin, nickel & vanadium together	0.5 mg/m3

Dioxins and Furans:

Maximum Toxic Equivalent Value(TEQ) 0.1 ng/m3

Odours:

No offensive smell outside premises.

Plume:

No visible plume within 5 minutes of start up.

MOD does not enjoy Crown Exemption from the EPA although operational training activities are necessarily exempted from noise and smoke provisions. This does not extend to range activities which are unconnected to operational requirements, such as logistic disposal of ammunition stocks. This imposes a clear requirement on MOD to ensure its procedures meet the provisions of the EPA.

MOD STUDY INTO DEMILITARISATION NEEDS

It was against this background that in 1989 the MOD conducted a detailed study into UK and overseas ammunition disposal techniques with the aim of identifying a cost effective and environmentally safe approach to demilitarisation.

FINDINGS

The study found that the MOD needed to demilitarize between 2000 and 5000 tonnes of ammunition each year and recommended that this be achieved using the following means:

1. Contract to industry for the demilitarisation of all large production runs or items representing specific hazards.

2. The establishment of a Tri Service Ammunition Demilitarisation Facility (TADF) designed to process ammunition which was not suited to contract disposal.

3. Open range demolition should continue to be used in a limited way for the disposal of some high explosive filled items by detonation and conventional propellants by burning.

Having provided some background into the reasons for change in UK I will now concentrate on the TADF for this is the project currently foremost in our minds.

DEVELOPMENT OF A TADF

CONCEPT

Although we intend to rely on industry for the majority of our demilitarisation requirements we believe that there will always be a need to process some munitions within the Service. In particular we want to establish the TADF to handle those incidental quantities that arise from stockpile surveillance activities and also items recovered by EOD operations throughout UK. We anticipate the annual throughput will range from 700 to 1700 tonnes.

In developing the TADF concept we were conscious of the need to meet the following broad requirements:

1. **A Wide Spectrum of Natures Handled.** The ammunition and explosives processed by the TADF will comprise small quantities of items from an extremely diverse range of different designs and fillings. Current service items will

cover almost the complete MOD inventory and EOD recoveries will span various countries of origin and may well go back a hundred years or more.

2. **To Function as an Ammunition Process Building.** To achieve operating economies, it is intended to locate the TADF in a major ammunition storage complex, within an Ammunition Process Area. The preparation and demilitarisation processes will be integrated , rather than being separated with the incineration process located in a remote demolition area. This requires that the complete TADF operates in accordance with explosives safety regulations for ammunition process lines.

Designing a facility to handle a wide range of natures invariably involves some compromise in the design and selection of the demilitarisation process. In the final analysis, it is very difficult to cover every possibility. After detailed study we concluded that rotary kiln incineration offered the most flexible approach and lowest technical risk for the TADF.

The range of items to be processed by the TADF are as follows:

1. Small Arms Ammunition.
2. Pyrotechnics, including smokes, dyes and CS compositions.
3. Grenades, fuzes, primers, and similar.
4. Carrier Shell.
5. HE filled munitions up to 600mm diameter and 1200mm long.
6. Cast Rocket Motors, up to 600mm diameter and 1200mm long.
7. Contaminated metal (EOD scrap).

We recognise that successful processing is highly dependent on effective preparation of munitions prior to incineration to ensue correct sizing and venting and on tight control of the feed and incineration phases. We are also aware that it will not be feasible to design the TADF to handle literally every munition in our inventory. There will be some munitions which require special processes and others where the throughput will not justify the investment to cater for them.

FUNCTIONAL LAYOUT OF THE TADF

The main functional areas of the TADF are shown at Diagram 1. It is our intention that these areas should be provided within one facility as this will afford the most efficient operation. Of course there will be a need to protect those process areas which are manned from an event in adjacent areas and this will require container traverses and some physical separation.

This facility will be constructed on a green field site within the Ammunition Processing Area of the Army's Central Ammunition Depot (CAD), Kineton, Warwickshire. This CAD is a modern facility with excellent infrastructure support to assist optimisation of TADF operating efficiency.

The functional areas of the TADF are largely self explanatory and similar to other processes which have been discussed in this forum before. I will therefore restrict myself to those aspects which I believe are of special interest.

IDENTIFICATION

Identification of items intended for processing is important in any demilitarisation facility, but especially so in the case of the TADF which will handle a wide range of items including EOD recoveries. For

this reason the TADF will incorporate X-Ray and facilities allowing the chemical analysis of fillings to ensure the positive identification where necessary.

PREPARATION AREA

The Preparation Area comprises three main process lines.

1. **Contaminated Metal.** This line will process EOD scrap which is normally received in post pallets. Where necessary it must be cut to size for feeding into the incinerator and/or mutilated to destroy military characteristics.

2. **Small Munitions.** This line will handle the majority of live items processed by the TADF. The initial work stations allow for unpacking and removal of inert components which should not be fed through the kiln. Where necessary munitions will be vented by punching or shearing to minimise the potential for transition to detonation in HE or high energy pyrotechnic fillings.

3. **Large HE Warheads and Cast Rocket Motors.** This line will incorporate a high pressure water jet cutting machine to expose fillings and size them to enable controlled incineration. Although water jet technology is now well demonstrated we do not believe that a process for handling explosive contaminated water has yet been proven. The development of a suitable machine therefore represents a real challenge to us.

Only one process line will operate at a time and at this stage we do not envisage mixed feeds. This is clearly feasible in theory and may be a later development. For example, where live items are fed at a rate below the capacity of the kiln, it would be possible to mix in contaminated scrap to achieve higher throughputs.

EMISSION CONTROL

The TADF will need pollution control equipment capable of handling the wide spectrum of munitions that we anticipate processing and ensuring that air emission limits specified under UK environmental regulations are not exceeded. At the moment we anticipate the pollution control equipment will have to comprise an afterburner, cooling system, scrubber, particulate removal process and dehumidifier.

Water treatment processes will also be required should the TADF incorporate a wet scrubber in pollution control, a high pressure abrasive waterjet machine in the Preparation area or a water deluge system to ensure process safety.

CONTROL SYSTEM

The TADF will incorporate a central computerised control system for the incinerator, pollution control equipment and automated preparation processes. This system will enable automated or manual control of operations and provide a separate safety loop to initiate progressive shut down should potentially dangerous situations develop.

We believe that this system will be essential to ensuring that transition to detonation does not occur when processing larger HE items as it will enable balancing of feed and fuel rates to maintain internal kiln temperatures within precise limits.

The control room will also be linked to automated processes in the Preparation and Incineration Areas by CCTV. In particular these will monitor sectioning of large HE filled items or cast rocket motors, the conveyor feed system, rotary kiln and discharge process.

IMPLEMENTATION PLAN

We are aiming to have the TADF built and commissioned by 1995. The feasibility phase of the TADF Project is now all but complete and we anticipate moving into the detailed design and construction phase in the near future.

Although the TADF will be built in an existing ammunition depot on MOD land it is still necessary to seek planning approval from local government authorities. This process has already commenced and is creating some local public interest. We anticipate planning approval early next year.

To reduce technical risk and development lead time, we will use existing technology and proven equipment where ever possible. For example, we intend to use the US DOD APE 1236 Rotary Kiln for incineration as it has a proven track record. The pollution abatement equipment on the APE 1236 does not meet our requirements and so will be developed separately.

CONCLUSION

We have been extremely fortunate in being able to draw on the experiences of the US DOD in developing the TADF project. There is no doubt that we would have otherwise spent many years in proving project feasibility and trialing the specific demilitarisation techniques before getting the TADF off the ground.

Despite this advantage we still face specific challenges to develop a facility able to cope with a wide spectrum of munitions in a cost effective way and also to meet the stringent emission control limits required by UK and EEC authorities. For this reason we feel the TADF will represent a positive move forward in the overall development of ammunition demilitarisation technology.

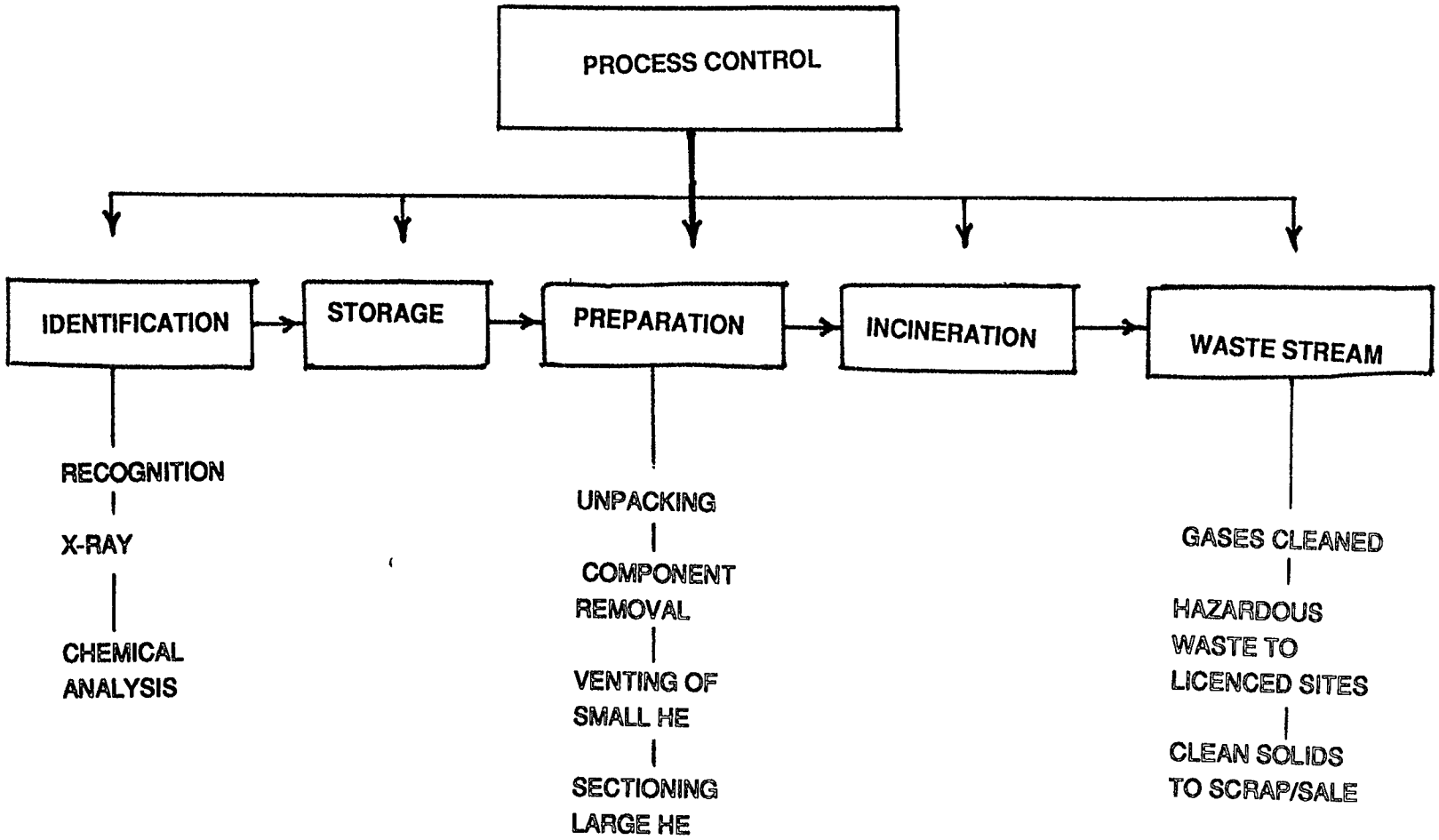
PROCESS CONTROL
IDENTIFICATION
STORAGE
PREPARATION
INCINERATION
WASTE STREAM
RECOGNITION
X-RAY
CHEMICAL ANALYSIS
UNPACKING
COMPONENT REMOVAL
VENTING OF SMALL HE
SECTIONING LARGE HE
GASES CLEANED
HAZARDOUS WASTE TO LICENCED SITES
CLEAN SOLIDS TO SCRAP/SALE

Diagram 1.